

Gaolie's best cows bring him a gross income of about Rs. 200 per head per annum, whereas cows of some of selected country breeds reared on Government farms have given yields worth Rs. 600 per annum and cross-breed cows have given yields worth Rs. 1,000 or even more.

Government cattle-breeding farms are sometimes thoughtlessly condemned because they are not self-supporting. Our critics forget, however, that until and unless our breeds of cattle are improved cattle rearing and dairying in this country will never pay as it ought to do. The task of remedying the defects of centuries must needs cost money and this money Government as well as enterprising land owners who take up this branch of animal husbandry must be prepared to sink in the industry in order to get more out of it. For a bull of a good milch pedigree they may not be able to get more than three or four hundred rupees, though the animal may be worth as many thousands. The people of this country do not as yet realise in short the value of pedigree and are not prepared to pay for in-bred qualities the value of which they do not realise. For these qualities cattle-breeders in more advanced countries pay large sums; pedigreed bulls have fetched over a lakh of rupees in England. Purchasers pay such prices and get full value for their money. As the building up of pedigree is a slow and somewhat expensive process, the question of initial costs should under the circumstances be a secondary consideration seeing that the value of the improvement is insignificant as compared with the cost of effecting it.

(To be continued.)

(From Planters' Journal and Agriculturist January 1926.)

Large Estate Farming in the Punjab.

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The writer having had an opportunity of visiting two of the large estates in the Punjab, was much impressed with the value of the work done on them, both for the Agricultural department and for the cultivators not only on the actual estates, but in the whole irrigated area of the Punjab. In the short time available it was not possible to acquire more than a general knowledge of conditions and this paper has no pretension to be an exact and critical examination

of the Punjab tenant system of *batai*, which broadly speaking, is one where the tenants cultivate the land and get half the produce, the other half going to the landlord. It is a system which has been long accepted, and it is not a recent development arising from irrigation and canal colonies.

The Punjab is particularly well suited to large estate farming with tenant cultivators, during comparatively recent years, the Govt. have opened up, by irrigation, what was formerly almost uninhabited desert land and therefore have had at their disposal large areas with no inhabitants, no existing system of land tenure and no vested interests. This land it was necessary to dispose of, some was allotted as a free grant and reward for military or other service, some was leased on special terms mentioned hereafter but a very large proportion was sold to meet part of the capital expenditure of irrigation, and was acquired by these inhabitants of the Punjab who had the capital and the foresight to realize the possibilities of such land. A considerable portion of the irrigated area thus consists of fairly large holdings cultivated on the tenant system, and consequently the grant of a limited number of comparatively large estates leased on special terms and for specific purposes has in no way dislocated existing conditions.

The development of virgin land under new conditions necessitated much experimental work by the Agricultural department if the native landholders were to be guided as to the right crops to grow, suitable rotation, amount of water etc. Experimental agricultural work on a large scale, however, involves additional capital expenditure, and the visible returns on such Government farms are usually small, for which reasons the number and scope of them is bound to be limited. To supplement the work of such establishments as the Agricultural and Research College at Lyallpur, the Government of the Punjab decided to allot to individual concessionaires large grants of land on lease for specific purposes. The following are the areas and the purposes for which they are being worked at present.

Area in acres.	Purpose.
21,000	To produce fodder for the army.
14,000	Horse breeding.
2,000	Experiments in steam cultivation.
9,000	Cattle breeding.
3,000	Seed production for the Agricultural Department.
7,000	To encourage staple cotton growing, test varieties, establish a buying agency for long staple cotton, <i>et cetera</i> .

These estates are leased for private individuals, to Government departments, and in one case to a company. The conditions on which they are held are strictly laid down and scrupulously carried out. Practically all are worked on the tenant system of *batai* by which half the water-rate, the land revenue, and the taxes is paid by the landlord, the other half being paid by the tenant.

The advantages of such estates to the Government are, as has already been mentioned, that they are partly part of the Agricultural department with which the lessees co-operate closely and cordially, and that they serve as model farms which farmers can visit in order to see modern and progressive methods of farming and experiments carried out on a field scale. The lessees also act as additional and unofficial channels of communication between the department and the agriculturists, and, finally, the estates represent a large amount of capital expended for the development of the country without expense or risk to the Government.

The tenants on these estates are far better off than those working on the property of the ordinary landlord, many of whom are absentees, while few take much interest in the cultivation of their lands by the tenants. On the special concession estates agricultural methods, rotation, system of watering, &c., are organized and controlled by the lessee, with the result that the yields are higher and the waste of water and labour is less than elsewhere. The tenants need not sink capital in buying agricultural implements, but can hire the best and most suitable from the landlord, who buys, stores, and maintains them. Inequalities in the nature of the soil are minimized by periodic redistribution of the various rectangles (of 25 acres) so as to ensure that no tenant gets land of poor quality every year. On most estates well-planned villages and roads are made, trees are planted, and wells are sunk by the landlord and as a rule a small hospital is maintained. Each village is organized and self-contained, and has its own carpenter, blacksmith, potter, carrier and sweeper, and in many cases its own spinners and weavers.

The crops are sold in bulk, thus ensuring good prices and fair dealing. Above all, the tenants can obtain monetary advances from the landlord on account of their crops, and so are kept out of the hands of the money-lender and usurer, and are independent to a degree which is rare both in India and Africa; they also have a direct share and interest in the development of the estate, and prosper in proportion to its prosperity and success.

It is scarcely necessary to mention that the advanced ²³ are not all on the side of the Government and the tenants. During recent years the high prices of agricultural products and especially of

cotton, have ensured for the landlords a considerable reward for the work they have done and the capital they have sunk. It is desirable that this should be so, for the lessees have been led to find a large amount of capital and to take a certain amount of risk in developing their estates. Moreover, unless profits are reasonably high there is always a possibility that an unscrupulous landlord might supplement them at the expense of his tenants.

The foregoing notes will, it is hoped, be sufficient to explain the general principles of these large estates in the Punjab. To recapitulate, they have been created so far as the writer is able to judge for the following reasons:—

- (a) To assist the Government in developing the land.
- (b) To build up a strong unofficial section of the population which is in close touch with and to a large degree representative of the native agriculturists.
- (c) To assist the Agricultural Department in the solution of problems connected with scientific tropical agriculture.
- (d) To serve as model farms and object lessons to native agriculturists and to level up the agricultural practices of the province.
- (e) To raise capital for work which a Government cannot normally or conveniently carry out.
- (d) To trade on a large scale in agricultural produce and to encourage co-operation in trading among landlords and tenants.
- (g) To better the conditions of the native agriculturists to ensure that they get a fair return for their labour and to educate them to work in partnership with a benefit landlord.

In order to achieve these results it seems essential, firstly that the organizers and managers of these estates should be the lessees themselves and, if this is not possible, that they should be directly and personally concerned in their success by means of a bonus on results. If such estates were managed by paid agents there would be a danger of weakening the intimate personal touch between landlord and tenant, which is so marked a feature and which contributes so largely to the success of the estates visited by the writer. The second essential is that such estates should be as large as possible so as to ensure an adequate amount of capital. It is most desirable

when it is possible to do things on a big scale especially in Tropical Africa, when as is subsequently suggested cultivation is to be combined with a fight against the tsetse fly, which not only infests hundreds of square miles of bush, but is encroaching an area of country that has hitherto been free of this pest.

(From the Empire Cotton Growing Review No. 4 1925)

Some Physiological Aspects of Pruning.

BY CHEESEMAN, B, SC.

An annual plant starting from the seed, forms first a small root and then a small shoot, utilizing for the purpose the food stored in the seed, and proceeds to grow in both directions till it flowers, sets seed, and dies. During this life-history it nourishes itself from two sources from the soil by means of its roots, and from the air by means of its green parts. The nutritive substances obtained from these two sources are of two very different kinds, but both are necessary for growth. The roots take in water and mineral salts, among which the most important salts from our present point of view are nitrates, which are built up inside the plant into more complex nitrogenous substances, whilst the leaves take in carbon dioxide, from which they build up carbohydrates, such as sugar or starch.

In the ordinary course of events the growing point, or points supplied from both sources produce for a time stem and leaves, and then flowers appear. These may be borne in various ways; sometimes they remain unchanged and the flowers are borne laterally, but in either case growth slows down, because the food materials that were being used in growth are now diverted to flower production.

The reason for this more or less sudden change of behaviour on the part of the growing point—the change from vegetative growth to reproduction, has for long been one of the interesting problems of plant physiology, and we are now a little nearer to a solution than we were a few years ago. It seems clear that the change is largely determined by the relative amounts of the two classes of materials, carbohydrates and nitrogenous substances, which are received by the growing points from other parts of the plant.

The nitrogen supply determines the amount of vegetative growth; it is a well-known fact that plants liberally supplied with nitrogenous manures make vigorous leaf growth, but as long as the nitrogen supply is continued produce little fruit. The carbohydrate supply on the other hand, is directly dependent upon the growth, for the more the growth the larger the leaf area, and consequently the greater